Plutonium In Soil

The critical parameters (k_{eff} = 1.000) for plutonium-water-soil systems were calculated using the GAMTEC II - DTF IV combination with eighteen group cross sections. According to Hansen and Clayton (1) this combination calculated experimental plutonium systems above an H/Pu = 25 with a slight conservatism, but in under moderated systems the results compared very well with experiment. The dry soil composition (representing Hanford area soils) and densities for two void volumes, 30 vol% and 40 vol% void, are shown below in atoms per barn-centimeter and g/cm^3 respectively (2):

Nuclide	30 Vol% Void	40 Vol% Void
O	.032860	.028166
Si	.014070	.012060
Al	.001242	.001065
Ca	.000966	.000828
Fe	.000552	.000473
Mg	.000516	.000443
Na	.000273	.000234
Dry Soil Density	1.701	1.458

For the saturated soil systems the void volume is assumed to be completely filled with plutonium containing 3 wt% Pu-240 and water.

(1) L. E. Hansen and E. D. Clayton, "Critical Parameters of Plutonium Systems," Nuclear Applications, Vol. 6, p. 371-390, April 1969.

(2) K. R. Ridgway and R. D. Carter, "Criticality Prevention Parameters of Plutonium in Soils," ARH-2622, October 5, 1972.